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GB 1015615
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(54) **Electrical circuit board connection**

(57) An electrical interconnection between adjacent printed circuit boards (100, 200) is provided by a first electrical contact (300) mounted to one board (100) and a second electrical contact (400) mounted to the other board (200). The contacts each include an elongated, electrically conducting body having an axially extending recess containing a plurality of contact wires each having a forward angled end surface. The rear ends of the wires are secured in place within the recess by crimping the body. The rear portion (334, 434) of the conducting body fits within a hole (180, 280) in the circuit board, and is soldered in place by a layer of solder (182, 282).

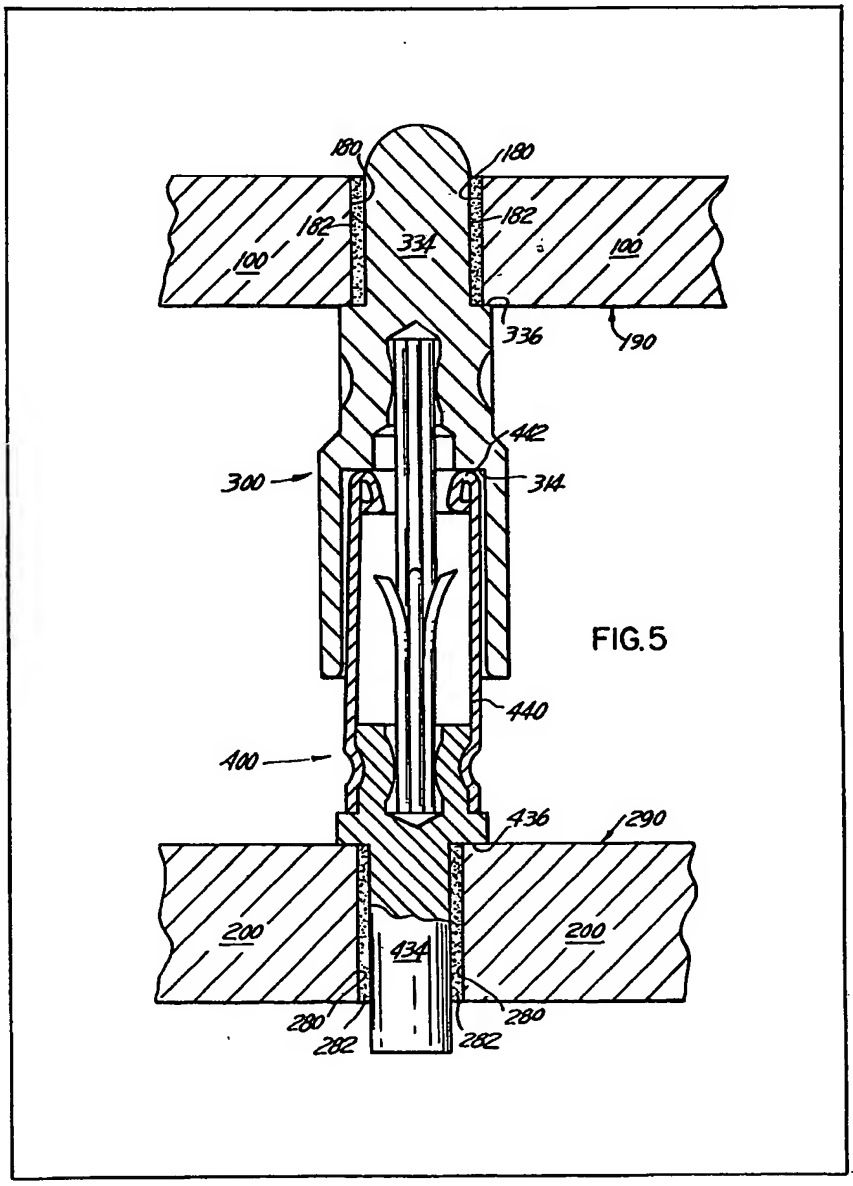

FIG.5

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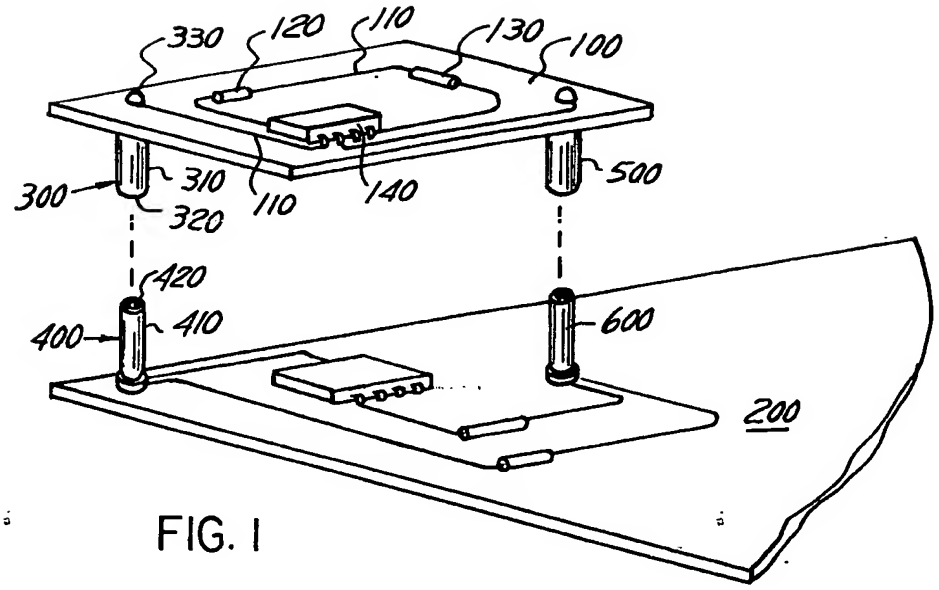
330
120
110
130
100
300
310
320
110
140
500
420
400
410
600
200

FIG. 1

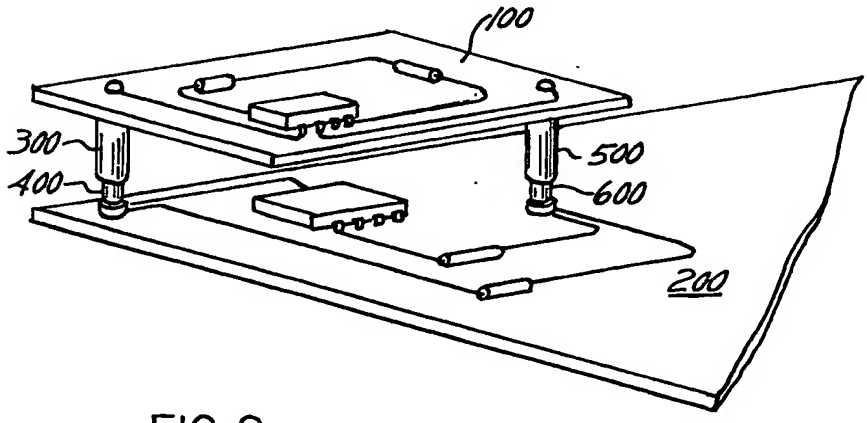
100
300
400
500
600
200

FIG. 2

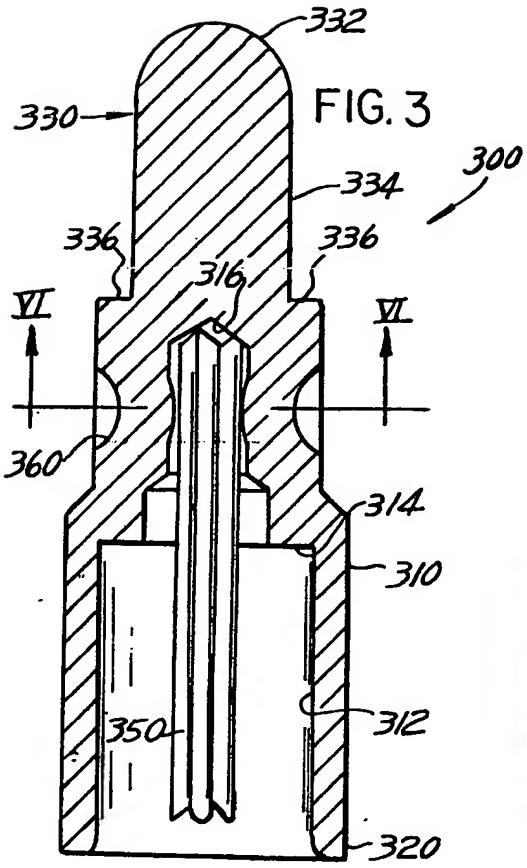

FIG. 3

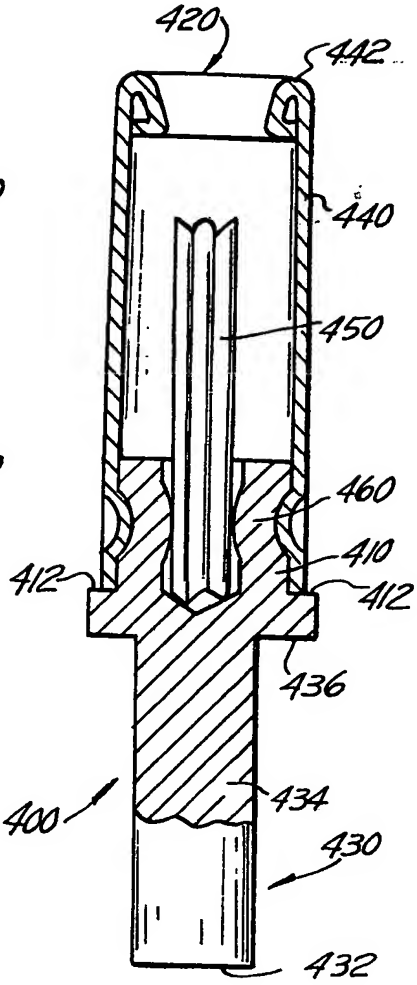

FIG.4

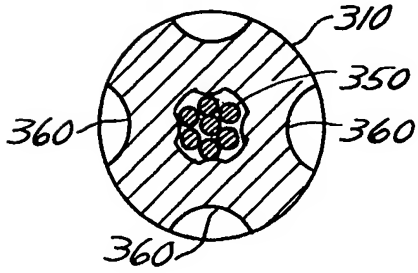

FIG.6

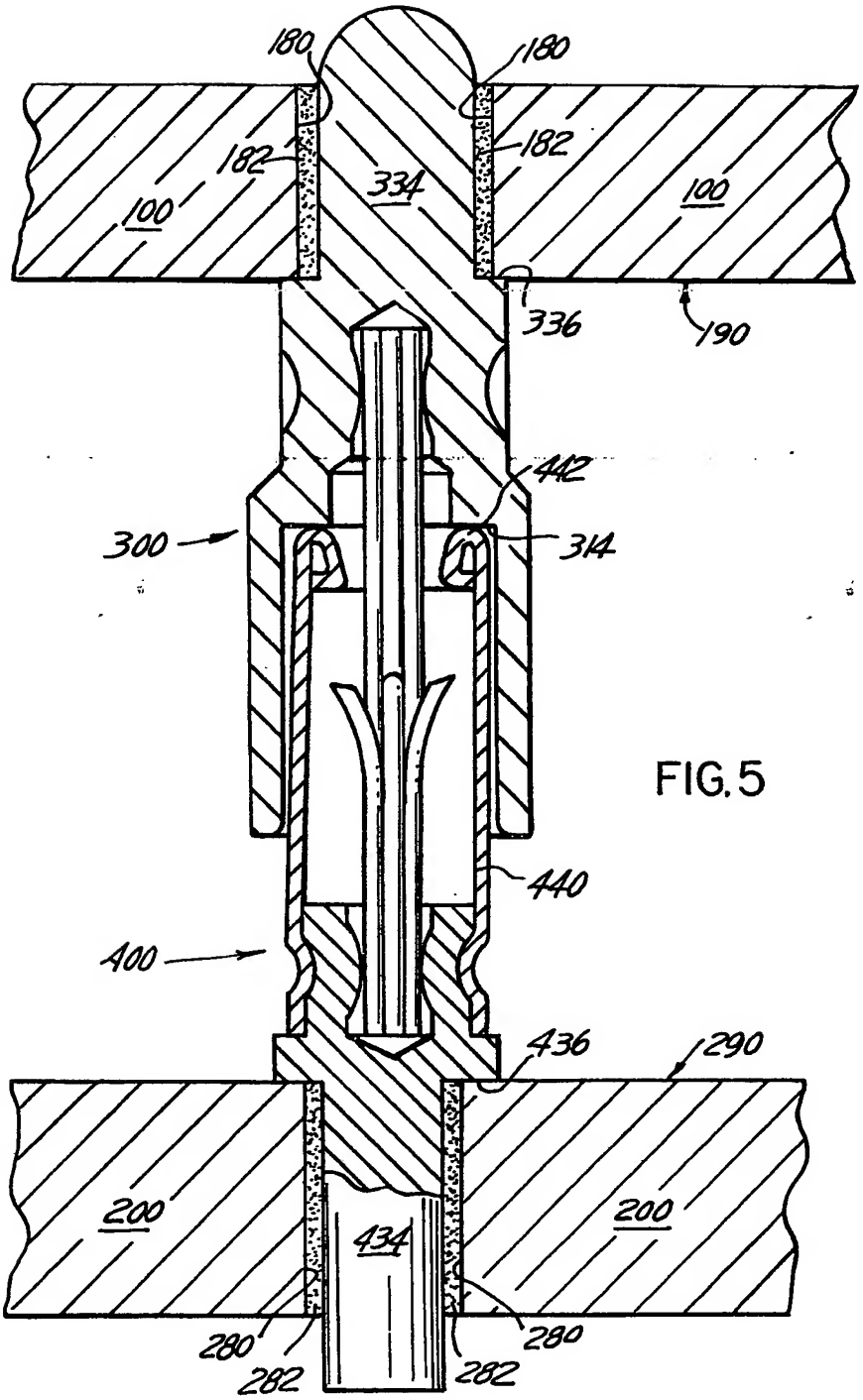
180
180
182
182
334
100
100
336
190
442
300
314
440
400
436
290
200
200
434
280
280
282
282

FIG.5

SPECIFICATION

Electrical circuit board connection

This invention relates to electrical connections or connectors. More particularly, this invention relates to an electrical connector assembly suitable for connecting two printed circuit boards together, or for providing an offboard connection to a circuit board, with an easily mated and unmated connection requiring low mating force.

Printed circuit boards are well known which include a plurality of electrical elements mounted on a thin, flat sheet of insulating material. A copper "clad" or thin conducting layer is applied over the insulating material in selected locations to provide interconnection in the proper arrangement between the individual elements on the board.

It is frequently desirable to provide an electrical connection between adjacent boards, or an "off-board" connection. Such connections must be easily and quickly made and non-destructively broken for replacement of a board upon failure of the electrical elements or the inter-connections. Also, in many applications, the off-board connections should be of low electrical resistance and assembled with a minimum insertion force.

Electrical wires between boards could be used, but are generally undesirably permanent. Such wires are also costly to assemble and vulnerable to damage.

Boards frequently are provided with edge terminals which fit into a recepticle which may wired to the recepticle of other boards. The wiring between recepticles is time consuming and permanent, and the insertion force to plug the board into the recepticle may be substantial.

Thus, the known prior art systems for interconnecting printed circuit boards have significant limitations and disadvantages.

The present invention overcomes the limitations and disadvantages of the prior art systems by providing a simple, inexpensive and low-mating force connection between adjacent circuit boards.

The present invention also may be used to advantage as an "off board" connection to another electrical element.

The connections of the present invention allow the quick disconnection of two circuit boards to allow a replacement of one. The reconnection of the replacement board is easily and quickly accomplished with the interconnection system of the present invention.

The connection system of this invention has the advantages of low resistance and low mating forces which is desired in many applications.

Further objects and advantages of the present invention will be apparent to one skilled in the art in view of the following description and claims and the accompanying drawings:

FIGURE 1 is a perspective view of portions of two printed circuit boards and the interconnection system of the present invention, prior to assembly of the boards into a mated condition.

FIGURE 2 is a prespective view of the boards and interconnection system of FIGURE 1, following the assembly of the boards and mating of the contacts.

FIGURE 3 is a cross-sectional view of one of the contacts used in the interconnection system of the present invention.

FIGURE 4 is a cross-sectional view of the other contact used in the present interconnection system.

FIGURE 5 is a cross-sectional view of the mated contacts and a portion of the circuit board assembly of the present invention.

FIGURE 6 is a cross-sectional view taken of one contact in FIGURE 5, taken along the line VI—VI looking in the direction of the arrows.

FIGURE 7 is a perspective view of a first, smaller circuit board 100 and a larger circuit board 200. Interconnecting elements (contacts) 300,400 are mounted to the respective boards 100,200 at a corresponding location. A second set of contacts 500,600 are mounted to the circuit boards 100,200, respectively, at another corresponding location.

The circuit boards (e.g. board) 100 are well known in the art, preferably being made of a sheet of thin, rigid insulating material having a cladding, or thin foil, of conducting material 110 (usually copper) attached thereto in selected locations. The conducting material 110 defines current paths between terminals of electrical elements 120, 130 and integrated circuits 140 mounted within holes through or sockets on the board 100.

The circuit board 200 is similar to the circuit board 100 in construction and included components, but may be larger in size. At least one of the boards is firmly coupled to an external structure such as a frame or base.

The contacts 300, 500 are preferably of the type shown in FIGURE 3 in a cross-sectional view and described in detail in connection with that view. The contact 300 has a body 310 which includes a forward mating end 320, which extends downward from the board 100 in this view, and a rear connection end 330 which extends above the board 110 and is partially visible in this view.

The contacts 400, 600 are preferably of the type shown in FIGURE 4 in a cross-sectional view and are described in detail in connection with that view. The contact 400 has a body 410 which includes a forward mating end 420 extending upward from the board 200 in this view. A rear connection end of the contact 400 exists, but is not shown in the FIGURE 4 view.

FIGURE 2 shows the circuit boards 100, 200 assembled with the contacts 300, 400 and 500, 600 mated. The contact 300 is mated with the contact 400, and the contact 500 is mated with the contact 600. The number of interconnecting contacts is determined by the circuit requirements and may exceed the two sets which are shown here for illustration. Advantageously, the pairs of mating contacts (e.g., contacts 300 400 are a pair of mating contacts) used are reasonably uniform is size to provide a uniform spacing between the

boards and to allow the proper mating of each mating pair of contacts. The pairs of mating contacts are spaced about the boards to distribute the weight load which the contacts bear, which may or may not be substantial, depending upon the application.

FIGURE 3 is a cross-sectional view of the contact 300. The contact includes the body 310 having the forward mating end 320 and the rear end 330. The rear end 320 may be integral with the body 310 or may be a separately made stem piece. In any event, the rear end 330 has a rounded or radiused tip 332 and a stem 334, which together exceed the thickness of the board to which it will be coupled. Forward of the stem 334 is a flat, annular shoulder 336 which surrounds the stem 334 and faces rearwardly.

A recess 312 extends rearwardly from the forward end 310 and includes a forwardfacing internal, annular shoulder 314 and a rear stop 316.

A plurality of axially aligned wires 350 are mounted within the recess 312, extending forwardly from the rear stop 316. A crimped portion 360 of the body retains the wires. These wires and their mounting are discussed in detail in the U.S. Patent No. 3725844.

FIGURE 4 is a cross-sectional view of the contact 400, showing the body 410 and the forward mating end 420. The body 410 terminates in a rear end 430 which is shown with a flat end 432 but may have a rounded end like the rounded end 322 of the contact 300 in FIGURE 3.

The rear end 340 of the contact 400 has a stem 434 and an annular, rear-facing shoulder 436.

A sleeve 440 is mounted to the body 410 and extends forwardly from a forwardly facing shoulder 412. The sleeve includes a folded over forward end 442 which has added rigidity for supporting at least a portion of the weight of the board.

Contact wires 450 are mounted in the contact 400 by a crimp 460 similar to that described in connection with the contact 300 in FIGURE 3. The wires 450 are axially aligned, each have a forward tapering or angled end surface.

The bodies 310, 410 of the contacts and the stems 334,434 are made from electrically conducting materials. The preferred material is a tinplated brass, although other materials such as stainless steel or copperbased alloys could be used. The sleeve 440 is preferably made from stainless steel.

FIGURE 5 shows the contacts 300, 400 coupled to the circuit boards 100, 200, respectively, and coupled together.

Each board 100, 200 has a hole 180, 280 therethrough for receiving the stems 334, 434 at least partiallly therein. The shoulders 336, 436 are positioned adjacent facing surfaces 190, 290 of the adjacent boards 100, 200 and support the weight of the board.

The stems 334, 434 are held within the prespective holes 180, 280 by a layer of solder 182, 282.

The forward end 442 of the sleeve 440 is supported on the forwardly facing internal shoulder 314 of the contact 300; which also supports the weight of the board.

FIGURE 6 shows a cross-section of the contact body 310, the contact wires 350 and the retaining crimps 360 which extend radially inward to hold the wires 350 in place within the body 310.

Other objects and advantages of the present inventon will be apparent to those skilled in the art in view of the foregoing description. For example, in place of one brush-type contact, a pin contact could be used as described in the U.S. Patent Application No. 928923. Also, in place of one circuit board, another circuit element having an appropriate contact type termination could be used. the foregoing description, accordingly, should be considered as illustrative only and should not be interpreted to limit the scope of the present invention, which is defined solely by the following claims.

CLAIMS

1. An electrical contact for use in providing an electrical connection to a circuit on a printed circuit board, said contact being characterized in that it comprises in combination:

an electrically conducting elongated body having an axially-extending recess extending rearwardly from a forward end and a rear conducting element;

a plurality of straight axially aligned conducting wires, each having a forward tapering end portion and a rear portion; and means for mounting the rear portions of the wires within the axially extending recess, said means including radially-inward extending crimps of the body in the region of the recess to secure the wires in place.

2. A circuit board conprising:

a flat sheet of electrically insulating material having an electrical element carried thereon and an electrical current path extending from the electrical element and mounted to the sheet of insulating material, said sheet including a hole extending through the thickness of the sheet; and means for providing an off-board electrical connection to the electrical elements characterized in that, said means includes:

an electrical contact having an elongated body having a forward mating end and a rear mounting end, said forward mating end including a plurality of axially aligned wires, each with a forward angled end surface, and a rear wire end secured within said body, said rear mounting end having a a end portion smaller than the hole in the sheet and inserted in the hole; means for coupling the contact rear end to the electrical current path and for mounting the contact within the hole.

3. A circuit board of the type described in Claim 2 wherein the means for coupling and securing the contact to the current path comprises a soldered joint between the body of the contact and the current path on the insulating material.

4. An electrical contact substantially as described and as shown in the accompanying drawings.

5. A circuit board substantially described and as shown in the accompanying drawings.

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